

**REMARKS****1. Rejection of claims 14-22 under 35 USC 112:**

The Examiner has indicated that claims 14-22 are rejected because the term "reaction layer" is unclear. The Examiner cites paragraph 18, which states that "the first  
5 reaction layer 11 and second reaction layer 22 comprise at least one material selected from a group consisting of SiNx, Ti, Cr, and the like materials." The Examiner has stated, "It is not clear from this selection what other materials could be used."

The Applicants amend the specification in paragraph 18 to limit the group to materials  
10 which can be used to create a hydrogen bond or ionic bond between the substrate layers and the transparent adhesive layer. This bond is discussed in paragraph [0017], where "The third stack 4 is formed by performing a chemical reaction to generate a hydrogen bond or an ionic bond between the second reaction layer 22 of the first stack 2 and the transparent adhesive layer 12, and to generate a hydrogen bond or an ionic  
15 bond between the first reaction layer 11 of the second stack 3 and the transparent adhesive layer 12. The chemical reaction is performed with an increased temperature and may additionally with an increased pressure." No new matter is introduced.

The Applicants respectfully request that the Examiner reconsider his rejection in light  
20 of the amendment to the specification.

**2. Rejection of claims 14, 21, and 22 under 35 USC 102(e) per Hen (US 6,563,139)**

The Examiner has indicated that claims 14, 21, and 22 are rejected as being anticipated by Hen in US 6,563,139. The examiner states that Hen illustrates "... a  
25 second reaction layer 803 formed on the first stack; a second stack 403; a first reaction layer (802 next to 805) formed on the second stack; a transparent adhesive layer (transparent epoxy, col. 5, lines 33-36) formed between the first and second reaction layers; ..."

30 With reference to Applicants' Fig. 5, claim 14 of the present invention teaches a first reaction layer 11 and second reaction layer 22 formed respectively on a second stack 10 and a first stack, with a transparent adhesive layer 12 formed between the first

reaction layer 11 and second reaction layer 22, resulting in improved adhesion that will not peel.

5 The Applicants wish to mention that Hen's patent is inconsistent between the specification and figures. The following argument covers all of the various possible interpretations of what Hen's patent may describe.

10 The Applicants note that Hen teaches that the blue LED chip is grown epitaxially on the sapphire substrate (col.4 lines 59-63), as is the green LED chip (col. 5 lines 17-19), not bonded by adhesion. The red LED chip is also formed epitaxially (col. 3 lines 21-23), and although Hen mentions a sapphire substrate for the red LED in the specification, he does not illustrate it. Epitaxy is not adhesion and hence is not relevant.

15 Referring to Hen's Fig. 7 and Fig. 8 (col. 4 lines 29-33) and assuming Hen's figures have primacy, Hen states that layers 802 and 803 are "a transparent conductive layer" (col. 4 lines 64-65), and that layers 403 and 805, respectively a "blue light LED chip" (col. 4 lines 59-60) and "a transparent sapphire substrate 805" (col. 4 line 61), are between them. Hen does not show a layer for the bonding agent, and furthermore it  
20 would not be bonding the transparent conductive layers 802 and 803 to each other since in Hen's Fig. 8 they are separated by layers 403 and 805.

However, Hen's specification is inconsistent with his drawings, stating that layers 802 and 803 are formed on both sides of the blue LED (col. 4 lines 63-66), both sides of  
25 the green LED (col. 5 lines 20-23), and only the top side of the red LED (col. 4 lines 42-44). Hen also states that the transparent conductive layer is a positive or a negative of LED chips. Furthermore, Hen states that the transparent conductive layer is "indium oxide (In.sub.2 O.sub.3) or other transparent conductive materials, with thickness of 200 .ANG. to 10000 .ANG., the better of 500 .ANG. to 1000 .ANG.." (claim 20). However, the "indium oxide" is not a reaction layer. Hen fails to teach or  
30 suggest that other transparent conductive materials can form a reaction layer, thus in Hen, the adhesive can peel.

Hen teaches that the separate LED chips can be bonded to each other by “thermal, ultrasonic, or transparent epoxy adhesion” (col. 4 lines 24-25; col. 4 lines 53-56; col. 5 lines 14-17; col. 5 lines 33-36), which are identical to the Applicants’ admitted prior art, referred to in paragraph [0005] of the present application. The red LED chip 401 is bonded by thermal, ultrasonic, or transparent epoxy adhesion to the PCB 405/905; the location of the epoxy layer is not illustrated by Hen, but the specification implies that it is between the common ground 701 of the PCB 405/905 and either the n-GaAs layer of the red LED 401 (col. 4 lines 53-59) or a sapphire substrate (mentioned but not shown anywhere in Hen’s diagrams) or a reflective layer made of gold, aluminum, or copper (col. 4 lines 37-42) which has been sputtered on the bottom of the red LED chip; it is unclear from Hen’s specification and figures as to which of these three possibilities is correct. The blue LED chip 402 is then bonded by thermal, ultrasonic, or transparent epoxy adhesion to the red LED chip 401; the location of the epoxy layer is not illustrated by Hen, but per his specification it is between the red LED’s transparent conductive layer 802 and the blue LED’s sapphire substrate 805 (col. 5 lines 14-17) or transparent conductive layer 803 (col. 4 lines 63-66), depending on whether Hen’s specification or figure is correct. The green LED chip 402 is then bonded by thermal, ultrasonic, or transparent epoxy adhesion to the blue LED chip 403; again, the location of the epoxy layer is not illustrated by Hen, but per his specification it is between the transparent conductive layer 803 of the blue LED 403 and either the sapphire substrate 805 of the green LED 402 (col. 5 lines 33-36) or the transparent conductive layer (not shown) of the green LED, again depending on whether Hen’s specification or figure is correct.

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Hen fails to suggest or teach that gold, aluminum, copper, PCB board materials, a sapphire substrate, or a transparent conductive layer made of indium oxide or other materials can form a reaction layer, thus in Hen, again, the adhesive can peel.

30 Each of these three bonds as shown in Hen’s Fig. 8, wherein the transparent adhesive layer (Hen, not shown) is applied between a first stack (Hen’s LED chips 401, 403, 402) and a second stack (Hen’s PCB 905 (incorrectly referenced in Hen’s specification

as 405) or the PCB's common ground 701, sapphire substrate 805 of green LED chip 402 or transparent conductive layer 802 of red LED chip 403, and transparent conductive layer 803 of blue LED chip 402 respectively), where the first and second stack each include a transparent conductive layer, are discussed in Applicants' paragraph [0005], "in which the light emitting diode is formed by adhering a transparent insulating adhesive layer" (Hen's transparent epoxy) "to an emitting stack" (Hen's 401,403,402) "and a transparent substrate" (Hen's common ground electrode 701 of PCB 405/905 or the PCB 405/905 itself, sapphire substrate layer 805 of green LED chip 402 or transparent conductive layer 802 of the red LED chip 401, and transparent conductive layer 803 of the blue LED chip 403). "The adherence is achieved by Van der Waals forces. However, the Van der Waals forces are too weak to hold the emitting stack" (Hen 401,403,402) "and the transparent substrate" (Hen 405/905,805,803) "in place. Therefore the emitting stack may come off the transparent substrate easily." Thus Hen fails to anticipate claim 14 of the present application.

Claim 14 should be allowable over Hen.

Regarding claims 21 and 22, these claims are dependent on claim 14, and should be allowed if claim 14 is found to be allowable.

Applicants therefore respectfully request reconsideration of Examiner's rejections.

3. Rejection of claim 20 under 35 USC 103(a) as being unpatentable over Hen in view of Chang (US 6,583,443).

The Examiner has stated that claim 20 is disclosed in Hen in view of Chang, as Chang discloses the use of BCB as an adhesive between LEDs.

Regarding claim 20, this claim is dependent on claim 14, and should be allowed if claim 14 is found to be allowable.

Applicants therefore respectfully request reconsideration of Examiner's rejection of claim 20.

Sincerely,

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Date: OCT 22 2004

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